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ABSTRACT

This paper provides an overview of traumatic brain injury (TBI), including incidence, definition, characteristics, assessment and identification, remediation, teacher responsibility, and parent involvement. It discusses the eligibility of students with TBI to receive appropriate and related services in school under the Individuals with Disabilities Education Act, and the need to understand cognitive and behavioral characteristics of children with TBI to be able to provide appropriate services. These characteristics include reduced stamina, significant motor or balance problems, seizures, headaches, hearing and vision losses, lack of impulse control, memory loss, attention and concentration problems, and problems with psychosocial adjustment. Academic problems that children with TBI might have are also described, particularly problems with arithmetic, reading comprehension, and language impairments. The effects of TBI on children at different ages are also explained, as are the differences between students with TBI and students with learning disabilities. The assessment of children with TBI is discussed and strategies are provided for educators helping children with TBI transition. Successful behavior modification strategies include immediate feedback, intermittent reinforcement, visual cueing, and verbal prompting. The need for teachers to individualize instruction in order to help children with TBI learn successfully is emphasized. (Contains 30 references.) (CR)

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Traumatic Brain Injury. An Overview Look at Effects and Strategies for Remediation

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A Research Paper Submitted to the Faculty of the Department of Special Education at Chicago State University in Partial Fulfillment of the Degree of Master of Science

May, 1999

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Approval

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May 10, 99
Date

Abstract

An overview of traumatic brain injury including, incidence, definition, characteristics, assessments and identification, remediation, teacher responsibility, and parent involvement was researched by this author. Traumatic brain injury is the leading cause of neurological impairment among children. Over 165,000 children will be hospitalized and rehabilitated in order to return to school. Under the Individuals with Disabilities Education Act, and or Public Law 101-476, traumatic brain injured students are eligible to receive appropriate and related services in school. A crucial factor in the child's future success in school, the family, and social setting is the understanding of the child's new cognitive and behavioral characteristics. Families can support the success of their child suffering from a head injury by playing a role in the planning of their academic future. Socially, immediate feedback and intermittent reinforcement are powerful behavior tools as are visual cueing and verbal prompting. Teachers will recognize that children with a head injury have trouble generalizing and transferring classroom learning to other situations. Therefore, it is important that teachers individualize instruction for each child to help him/her learn successfully.

Method

This writer accessed the Chicago State University web page on Netscape to obtain link sites through the provided webliography to gain information and research for this paper. Sites accessed were ERIC and Lightspan Educational Network. From these sites the writer found journals on traumatic brain injury. In these journals, the writer found other sources from the reference lists. From the references in these journals the writer found other valuable sources that provided pertinent information needed for this review of literature. This writer discussed the implications of a traumatic brain injury of school-aged children. This special education population is rapidly growing in our schools and a great deal of information on this subject was found in journals and on the Internet. This writer intends for this information on traumatic brain injury to be helpful for educators and families allowing them to understand how to best accommodate these students in various settings.

Introduction

Traumatic brain injury (TBI) is defined within the Individuals with Disabilities Education Act (IDEA), as an acquired injury to the brain caused by an external force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. The term applies to open and closed head injuries resulting in impairments in one or more areas, such as cognition, language, memory, attention, reasoning, abstract thinking, judgement, problem-solving, sensory, perceptual, motor problems, psychosocial behavior, physical functions, information processing, and speech (U.S. Federal Register, 1992). IDEA includes TBI as a separate disability category. It should be easier for TBI students to receive the services to which they are entitled.

While the majority of TBI students return to school, their educational and emotional needs are likely to be very different from they were prior to the injury (Szekeres, 1994). Although children with TBI may seem to function much like children born with other handicapping conditions, it is important to recognize that sudden onset of a severe disability resulting form trauma is very different (Janus, 1997). The trauma impacts family, friends, and professionals who recall what the child was like prior to injury and who have difficulty in shifting and adjusting goals and expectations (McNeill, Schuyler, Ezachi, 1997). Finally, it is of utmost importance that the trauma center, rehabilitation hospital, and special education team come together and collaboratively find the best ways to meet the needs of the TBI student (Holland, Hogg, Farmer 1997).

Review of Literature

Incidence

More than one million children sustain head injuries annually resulting in one degree or another of a traumatic brain injury or TBI. TBI is the leading cause of death and disability in children and adolescents in the United States. The most frequent causes of TBI are related to motor vehicle crashes, falls, sports, and abuse/assault. Of these one million children who sustain head injuries; approximately, 165,000 require hospitalization. Of this group, 16,000 to 20,000 will suffer injuries serious enough to cause permanent effects. This translates to 1 in 500 who will be hospitalized for a TBI. Boys outnumbering girls about 2 to 1 (Jennet, 1996).

It is likely that children with mild injuries will not be hospitalized or, if so, only for a brief observation period. Most mild injuries do not cause lasting learning or behavior problems. But some not classified as severe, cause lasting effects on a child's functioning. Some believe that every head injury produces some permanent effect on the brain (Dijkers, 1997).

Traumatic Brain Injury Defined

Traumatic Brain Injury (TBI) is defined within the Individuals with Disabilities Education Act as an acquired injury to the brain caused by an external force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. The term applies to open and closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory: attention; psychosocial behavior; physical functions; information processing;

and speech. The term does not apply to brain injuries that are congenital or degenerative, or brain injuries induced by birth trauma. (U.S. Federal Register, 1992).

The National Head Injury Foundation calls TBI the "silent epidemic," because many children have no visible impairments after a head injury (Shiel, 1998). Symptoms can vary greatly depending upon the extent and location of the brain injury (Jennett, 1996). However, impairments in one or more of the areas (such as cognitive functioning, physical abilities, communication, or social/behavioral disruption) are common. These impairments may be either temporary or permanent in nature and may cause partial or total functional disability as well as psychosocial maladjustment. A school district in a small community will deal with 3 or 4 head injured children every year, and a large metropolitan district may have 75. However, most schools have no formal way to identify and integrate these children into special programs and services. That is why TBI is often called the "silent epidemic." (Sheil, 1998).

Effects of Traumatic Brain Injury

A traumatic head injury is caused by a blow or wound that results in an alteration of consciousness (even brief) that affects behavior controlled by the brain. Most head injuries in children are closed head injuries. If the head is struck by a moving object or the moving head encounters a stationery barrier (as in a car accident), the brain suffers two types of effects the primary effects of injury an the secondary effects (Bigler, 1996).

Primary effects of the injury are the permanent result of tissue damage and will never be undone. These effects are caused by impact, tearing and rotating the brain. The brain is a soft mass floating within the hard, unyielding skull. On impact, the brain moves faster than the skull and slams against the inside of the skull, resulting in a coup injury.

The brain then rebounds and strikes the inside of the skull on the opposite side, resulting in further tissue damage referred to as contracoup injury. The brain usually scrapes against the skull's rough bony projections as it moves violently around inside the skull. This causes further tearing of brain tissue and blood vessels (Bigler, 1996).

As the brain twists and rotates, there is strain that causes shearing damage to the delicate brain fibers and further blood vessel damage. This stretching and tearing of the billions of thread-like nerve fibers is significant because the connections that are severed will never function again. The nerve connections that are merely stretched may recover or may degenerate further and may finally come apart (Bigler, 1996).

The secondary effects represent another class of physical changes in the brain that will affect the child's status after the injury. The most common is swelling due to fluid build-up. This may lead to increased intracranial pressure, which further compresses small blood vessels causing more herniation. Tissue dies when deprived of oxygen. Hemorrhaging may continue from damaged vessels. Accumulated blood may cause further pressure and harm more tissue. If surgery is necessary, additional tissue may be destroyed in the process (Bigler, 1996).

There are many physical, physiological and neurological changes in the child as a result of the injury. Some of the more dramatic early effects are due to the changes in the brain. The first is a coma or loss of consciousness ranging from a few minutes to weeks or longer. The child is in a coma when he or she does not open the eyes, follow commands or speak (Shiel, Wilson, 1998). Coma depth and duration measure the severity of the injury. This is frequently quantified by use of an observation scale such as the Glascow Coma Scale, which assesses levels of consciousness. There is a direct

relationship between the duration of the coma and degree of later cognitive impairment (Sandel, 1996). The second is motor problems such as weakness, tremors, rigidity or involuntary movements (Shiel, Wilson, 1998). Third, there may be an alteration of affect since the physiology of emotion is disrupted. This may lead to agitation and aggression or a marked lack of emotional expression. The child may also show anxiety or depression, or uncontrolled or inappropriate emotions (Kehle, 1996). The fourth, are memory disorders that are common. The injury may disrupt the brain's ability to register and store experience (Suhr, Wefel, 1997). The child may be unable to recall events surrounding the accident (amnesia). The child may never be able to remember what happened because the brain did not store these impressions at the time of the accident. Children may make up a story about what happened or will relay on what others tell them about the accident (Ylvisaker, 1998).

Children who have been in a coma may experience a period of post-traumatic amnesia (PTA) for several days. PTA is the time during which current events are not stored in memory. During this period the child is unable to maintain a continuous memory for events that have happened during the day. The duration of the PTA is frequently used in combination with coma duration to classify the injury's severity. Generally, a PTA of a week or longer is associated with poor outcome and persistent cognitive impairments (Suhr, Wefel, 1997).

After Effects of Traumatic Brain Injury

There are many significant physical after effects of brain injury that are important for schools to recognize including reduced stamina, protective services, re-injury, seizures, headaches, hearing and vision losses, and sports.

Reduced stamina may last as long as a year. This may be related to limited endurance, and problems of attention and concentration. Seizures or medication for seizures of spasticity may further limit endurance. Reduced stamina often prevents the child from initially attending school for the entire day. Even those children who have made good physical recovery may require a reduced school day for many months (Blosser, Pearson, 1997).

Protective services need to be considered for the returning TBI student to school. Schools need to carefully consider the TBI's need for physical protection. Children with significant motor or balance problems may require an attendant or a protective helmet. These children require supervision on the playground and while moving around the school building (Clarke, 1996). The degree to which a child can participate in regular physical education must be considered. Decisions about driver's education should be made in consultation with the child's physician.

Children who have suffered a head injury have a higher than average risk of another head injury (Jennett, 1996). Behavioral factors may predispose a child to head injury in the first place and new problems of impulse control, judgement or balance pose additional risks (Kehle, 1996). TBI children must be protected from further injury because another injury compounds injury effects.

TBI students are more likely to develop seizures than non-injured students are. Some will have seizures soon after the injury and some children will develop seizures of later onset. Seizures following TBI can be controlled by medication. When the TBI student returns to school it is important to know of the child's seizure and medication status (Suhr, 1997).

Headaches are common, particularly among children in the later elementary school years and older. Complaints of headaches are significant and signal a need to get information from the child's physician about how to manage them (White, 1997).

Conductive or sensorineural hearing losses may occur after injury. Some of these losses resolve, others do not. Approximately 40% of TBI children experience dizziness related to auditory problems. In half of these children, the problem may persist for as long as six months. There may be visual problems as well. Children may have visual acuity losses, a restricted visual field, or double vision following a head injury. Some of the visual problems resolved during the first year, but the school must be sure that the child has had a recent opthalmological examination (waop@eyes.org.)

Sports participation is always an issue. Generally, the child should be barred for up to a year from any contact sport in which there is a risk of being pushed, falling, or making contact with an object. Skiing, boxing, wrestling, football, and basketball should be prohibited. Generally, sports such as swimming, tennis and running are acceptable.

Cognitive aftereffects include memory, intellectual functions, attention and concentration, academic functioning, language and psychosocial adjustment. While each child displays a unique recovery pattern, there are some general classes of cognitive aftereffects that will influence educational performance. The frequency and severity of these problems are directly related to the severity of the head injury.

Memory deficits are probably the most common and long lasting problems faced by TBI students. Memory deficits adversely affect educational progress. Material the student learned before the accident may be lost and learning new material may be difficult. The head-injured student may not remember a specific math procedure, not

even recall ever learning it. Short-term memory problems often are even more significant. These deficits interfere with a student's ability to succeed in tasks involving new learning. A child may have difficulty returning to a task if interrupted. Memory deficits also affect a child's adjustment to non-instructional aspects of school. Activities of daily living are no longer automatic for the head-injured student. Organization will be difficult. Study skills and specific class routines will also be challenging (Suhr, 1997).

Students with TBI suffer a decline of intellectual functioning following head injury. The degree of impairment and the pattern of residual deficits are related to the location and severity of the injury. There may be progressive improvement, however, in measured intelligence for up to five years following injury. Children with mild to moderate injuries whose intelligence test scores decline after injury may eventually return to pre-injury levels. More severely injured children may only have partial recovery of those functions tapped by the test (Nabors, 1997).

Problems of concentration and attention are very common following head injury. They occur after mild as well as more severe injury and represent major impediments to the child's ability to function again in school. TBI will intensify prior problems of attention (Anderson, 1998).

Academic performance often is significantly affected by moderate or severe TBI. During the initial stages of recovery, arithmetic skills appear to be most vulnerable to disruption. Problems may be due to computational deficiencies, difficulty focusing and sustaining attention as well as difficulty organizing work. Reading comprehension is the academic area most often impaired in the long range (Vieth, 1996). One or two year delays are common. Recovery to pre-traumatic levels following head injury does not

guarantee continued achievement at pre-injury rates. Head injury has a major impact on new learning (Savage, 1997).

Language is often impaired as a result of head-injury. Such language problems even if subtle, may have significant adverse effects on academic functioning. In the early stages of recovery, children may display problems with oral fluency, speaking rate, naming, word retrieval and comprehension of complex sentences. Language problems may follow head injuries sustained at any period of childhood; however, younger children will have greater residual problems with written language than adolescents, since this is not yet a well enriched skill for them (Veith, 1996).

Psychosocial adjustment is another area, which is affected after a brain injury. TBI children often display a number of behavioral problems. Some of these problems appear immediately after the head trauma and gradually decline over time. Some develop when the child returns to school and is faced with unattainable academic and cognitive demands (Kehle, 1996). Behavior problems may present for years after head injury and can be permanent. While there is no pattern of behavior problems unique to head injured children; typical problem behaviors include overactivity, restlessness, destructiveness, aggression, tantrums, impulsiveness and socially uninhibited behavior(Ylvisaker, 1998).

Some of these behavior problems are due to the injury itself. Others arise from the child's reaction to the damage and the cognitive and academic deficits. For example, a decreased attention span and concept formation deficits may impair the child's academic functioning. This in turn results in decreased self-esteem. Lower self-esteem may lead to acting out. Impulsiveness and poor judgement in social situations may contribute to poor relationships with peers and family members. Furthermore, increased awareness of these

difficulties may lead to depression, anger and risk taking. All of the above may be compounded if adults do not recognize the residual deficits and try to place unreasonable demands on the child (Ylvisaker, 1998), (Kehle, 1996).

While the severity of head injury is directly related to cognitive difficulties, the relationship between psychosocial adjustment and severity of injury is more complex. It is difficult to sort out in a given child if post-injury behavior problems are due to the injury or also might be attributed to pre-injury personality traits. Psychosocial difficulties and a family's ability to cope with the injury confound the picture. In some cases behavior problems reflect pre-injury behavior which has been amplified by the injury. Clearly, the greatest success in decreasing the psychosocial problems accompanying severe head injury will come about only when we address all contributing factors (Kehle, 1996).

Traumatic Brain Injuries at Different Ages

Pre-School

The effects of head injury are different depending on a child's developmental stage. Children who are injured during the pre-school years, even those with severe injuries, may look very good after the injury. They recover motor and speech skills, and often teachers and parents expect that they will develop and function normally in subsequent years. These children often develop academic problems when higher order skills and functions are needed. An IQ may be normal, but the child still has significant academic difficulties (Janus, 1997).

Early Elementary School

Early elementary school age children have developing brains and injuries producing a coma of 24 hours or more are likely to produce persistent intellectual difficulties. While they respond well to school resumption, these children are likely to have difficulty as they progress through the grades. They are able to store and recall facts fairly well. Obstacles arise as they encounter demands for higher level cognitive functioning. We may even find that their intelligence test scores decline (Janus, 1997).

Early Adolescence

Head injury in early adolescence presents special problems for children and schools. Although head injuries at this age may not have such profound effects on intelligence as in younger children, the behavioral and emotional effects may be greater. At this age, students are very concerned about physical appearance and social skills. Head injury interferes with the developing sense of self. Loss of confidence and feelings of depression may lead to isolation from peers. Issues related to sexual development and impact of the injury on future psychosocial functions become important (Kehle, 1996). Psychological counseling is generally needed for children in the older elementary and early adolescent years. Such counseling may be required for 2 to 3 years to help the child deal with the multiple psycho-social effects of the head injury. If the child who sustained the head injury had behavioral or emotional difficulties prior to injury onset, it is likely that the subsequent psychosocial adjustment will be significantly impaired (Donders, 1994).

Adolescence

A traumatic brain injury occurring in adolescence has special implications for academic functioning. High school class work requires complex cognitive and reasoning skills that range from difficult to impossible for the traumatic brain injured student. Another problem may arise because adolescents are planning their future. The student is looking forward to finishing high school and getting on with the next step of life, which may mean higher education or a job. The student has been anticipating leaving high school and gaining independence from family. It is difficult for the student to accept the need for taking time from school to recover from the head injury, or to delay graduation because of a reduced course load or a shortened day. When there are sufficient residual deficits to indicate special services within the school, it is better that the student delay high school graduation to use school services that would not be available after graduation. This, however, can be a very difficult step for a high school student to consider (Kehle, 1996).

Characteristics of Traumatic Brain Injuries

Children who sustain TBI may experience a complex array of problems. Physical impairments include: (Russell, 1993) and (Savage, 1997).

- Speech, vision, hearing and other sensory impairment
- Headaches
- Lack of fine motor coordination, spasticity of muscles, paresis or paralysis of one or both sides
- Seizure disorders, balance, and other gait impairments.

Cognitive impairments include: (Salter, 1998).

- Short and long term memory deficits,
- Impaired concentration, slowness of thinking, and limited attention span
- Impairments of perception
- Communication, reading and writing skills
- Planning, sequencing, and judgement

Psychosocial, behavioral, or emotional impairments include: (Kehle, 1996) and (Ylvidaker, 1998).

- Fatigue, mood swings
- Denial
- Self-centeredness
- Anxiety, depression, lowered self-esteem
- Sexual dysfunction
- Restlessness
- Lack of motivation
- Inability to self-monitor
- Difficulty with emotional control, inability to cope
- Agitation
- Excessive laughing, crying
- Difficulty relating to others

Environmental factors include: (DeJong, 1989) and (Dijkers, 1997).

- Noise
- Temperature
- Visual distraction

- Unexpected change (class location moved, class canceled, etc.)
- Inadequate support/information/transportation
- Misunderstanding by others/rejection

Any of the impairments may occur to different degrees. The nature of the injury and its attendant problems can range from mild to severe, and the course of recovery is very difficult to predict for any given student. It is important to note that, with early and ongoing therapeutic intervention, the severity of these symptoms may decrease, but in varying degrees.

A majority of the children who suffer a TBI return to school. These students who return sometimes need different educational strategies to deal with their educational and emotional needs. Students who have suffered a TBI are entitled to receive special education services as any child who has learning difficulties does (Ylvisaker, 1995). The Individuals with Disabilities Education Act (IDEA), now includes TBI as a separate disability category. Under this category it should be easier for the students with TBI to receive the services to which they are entitled.

Differences Between Traumatic Brain Injured Students and Learning Disabilities

Students with TBI are too often inappropriately classified as having learning disabilities, emotional disturbance, or mental retardation. This is because on the surface, TBI students exhibit similar cognitive deficits. However, the National Head Injury Foundation cautions us to be aware of each population's unique needs. The National Head Injury Foundation states that the cognitive profiles of students with traumatic brain injuries differ in important ways from profiles of students with congenital learning disabilities or developmental delays. Service providers should be aware of the

differences between students who have a TBI and LD. Students with LD have usually lived with the disability all their lives. However, students with TBI have experienced a trauma and must reorient their lives accordingly. Differences between TBI and LD are as follows (D'Amato, 1996):

- TBI can have an academic profile, which changes frequently as recovery occurs over time necessitating ongoing program changes. This invalidates rigidly sequential curricula for most traumatic brain injured students.

- There is unpredictable progress for months and years after the injury, based on the neurologic recovery. Therefore, the pattern of academic functioning over time may be quite different than most learning disabilities.

- Assuming there was pre-traumatic mastery of a process or concept, TBI students often reacquire some material rapidly despite significant processing and learning problems acquired after the injury. The curricula emphasis for LD is thus appropriate for TBI students.

- In the early months following a TBI, there is more confusion, disorientation and lack of control than LD students. Further, TBI students might be more impulsive, hyperactive, distractible, verbally intrusive and socially inappropriate than LD students.

- Students with TBI may have to change a thoroughly habituated learning style that is no longer useful after the injury.

- There are different emotional stresses in that TBI students have to deal with a loss of capacity along with ongoing experiences of failure and frustration.

- There are more extreme discrepancies in ability levels for TBI students.

- TBI students may have more problems generalizing and integrating information. TBI students may need more individualized teaching, reteaching and monitoring.

- TBI students may need ongoing monitoring of tasks requiring independent thinking and judgement.

- TBI students may have difficulty processing information because their comprehension is decreased with more complex material.

- TBI students may need more compensatory strategies because of impaired memory, problems with word retrieval, information processing and communication.

- TBI students may have more difficulty with organization of thoughts, cause-effect relationships and problem solving.
- TBI students may be resistant to new, easier techniques and learning strategies because they want to use their pre-trauma techniques and strategies.

Many medical and educational professionals are unaware of the consequences of childhood head injury. As a result, the needed educational and related services may not be provided within special education programs. The designation of TBI as a separate category of disability signals that schools should provide children and youth with access to and funding for neuropsychological, speech and language, educational, and other evaluations necessary to provide the information needed for the development of an appropriate individualized education program (IEP). With these specialized evaluations, the TBI students educational and emotional needs will be better met (Russell, 1993), (Hux, 1996) and (Holland, 1997).

The TBI student's needs are very different from before the time of injury. Although children with TBI seem to function much like children born with other handicapping conditions, it is important to recognize that the sudden onset of a severe disability resulting from trauma is very different (Sziekers, 1994). Children with brain injuries can often remember psychosocial problems not usually present in children with congenital disabilities. Further, the trauma impacts family, friends, and professionals who recall what the child was like prior to injury and who have difficulty in shifting and adjusting goals and expectations (Martin, 1998).

Assessment of the Traumatic Brain Injured Child

The child, who has been injured severely and has experienced coma, may be sent to an in-patient rehabilitation facility (Sandel,1996). In reality, however, few children obtain

the specialized rehabilitation they need in order to transition back to daily life, including the demands of academic pressures and school expectations. If the child has received specialized TBI oriented rehabilitation, the chances are high that a comprehensive neuropsychological evaluation has been done. Ideally, members of an interdisciplinary team have contributed discipline-specific assessments and a comprehensive plan has been put together, which may be outdated by the child's progress but is nonetheless informative (Holland, 1997).

Learning is an activity of enormous complexity. It requires the interplay of a number of brain systems. Traumatic brain injury produces diffuse lesions that disrupt abilities at both basic and higher cognitive levels. Meaningful rehabilitation and education requires the identification of those cognitive skills that will be assets as well as those that will continue to be impaired. A comprehensive assessment is required to understand them fully (Holland, 1997).

Schools often do assessments of development and learning to determine the child's eligibility for a special program. For the returning head injured child this evaluation goal is not sufficient. The comprehensive assessment serves other purposes for the returning traumatic brain injured child. It provides a baseline of the child's present functioning against which measure future recovery. It identifies specific patterns of cognitive strengths and deficits. Finally, it determines if there are specific difficulties in language, motor and social/emotional functioning (Shiel, 1998).

Overall, a comprehensive evaluation of cognitive functioning is undertaken in the hospital when the child stops making rapid daily changes and is able to work for at least thirty minutes. A comprehensive evaluation includes assessment of cognitive and

information processing strengths and deficits, behavioral/emotional status, adaptive skills, speech and language abilities, and motor skills. It is ideal if staff from the child's school participates in this evaluation. Then the child's previous functioning can be discussed and future needs can be examined.

Assessment of academic functioning includes academic achievement tests that will show the basic academic levels the traumatic brain injured child has recovered. They will not predict future academic progress, and they may be inflated estimates of the child's ability to function in a regular classroom. Although they provide useful information about current functioning they should be interpreted with caution and should not be used in isolation to make placement decisions (Vieth, 1996).

Standardized tests such as the Weschler Intelligence Scale for Children-Revised provide another barometer of the child's recovery. Such tests provide a clue to the return of previously learned material. Scores on global intelligence tests do not provide complete information about the integrity of the traumatic brain injured child's cognitive functions. These score do not reveal the subtle cognitive problems that may affect new learning in the classroom. One must avoid using intelligence versus achievement test scores as the basis for making decisions about educational programming for traumatic brain injured children. IQ scores may be reduced after a head injury, and academic deficits may not show up on testing until later. Using intelligence/achievment discrepancy may prelude the traumatic brain injured child from receiving needed special education services because of lack of discrepancy in the scores (Nabors, 1997).

Nevertheless, standardized testing has a role in the assessment of traumatic brain injured children. It provides a global measure of recovery, and becomes part of a

comprehensive neuropsychological assessment. This assessment will provide information about future performance (Nabors, 1997).

Neuropsychological evaluation systematically measures a broad range of cognitive skills necessary for functioning in school and community. This evaluation defines the pattern of strengths and residual impairments and the degree to which the impairments will interfere with learning. A comprehensive assessment of all that the child brings to the learning situation provides information not only about the extent and intensity of residual deficits but also provides a basis for planning the cognitive remediation and educational programs that will best suit the child's needs. Neuropsychologists or other specially trained professionals provide such assessments. There are several standardized neuropsychological batteries that assess the common components of functioning and when coupled with intelligence and achievement tests, a neuropsychological evaluation provides a picture of how the child now performs in the following domains (Nabors, 1997):

- Global intellectual functioning
- Sensory and perceptual functioning in tactile, visual and auditory areas
- Language abilities
- Retained academic skills
- Motor functioning: simple motor efficiency, speeded output and complex psychomotor skills
- Problem solving and judgement
- Rate of information processing
- Organizational skills, intellectual flexibility and ability to use feedback

- Memory and capacity for new learning
- Attention, concentration and alertness
- Temporal and spatial ability

There is a need for ongoing assessment with the traumatic brain injured child. Most children in special education receive a comprehensive re-evaluation every three years. Traumatic brain injured children require evaluations more often. First, traumatic brain injured children look better on tests than they do in day to day functioning. Teachers may find that educational goals, objectives, and procedures will need to be altered as they work with the child on a daily basis. Dramatic and sometimes subtle but important changes occur quickly after a traumatic brain injury and result in the need for more frequent evaluations and changes to the IEPs for this population than for children with developmental disabilities for whom an annual time frame may be adequate. Even when there seems to be a "plateau" or leveling off, quantum leaps are possible at times, which may occur months or years after the injury (Shiel, 1998) and (Blosser, 1997).

Second, for younger TBI students, initial assessment after the injury will not provide an accurate picture of later development because there may be deficits in skills that had not yet developed at the time of injury. The fact that a preschooler may appear to be recovering well is no guarantee against future difficulties. Following head injury, children often have marked attention deficits. They may mask impairments of higher order skills (Shiel, 1998).

Finally, recovering children may improve in simple skills such as reaction time and concentration, but with maturity more complex functions become significantly more impaired. This results in discrepant developmental patterns that could not be identified

earlier. Therefore, there is a need for ongoing assessment of the TBI student (Szekeres, 1994).

Transitioning of the Traumatic Brain Injured Child

Some children will go into rehabilitation, often far from home, and some will return home immediately after the injury and medical stabilization. Communication with the family should be maintained throughout this period with active planning for a return to an educational setting. Some rehabilitation facilities have transitional classrooms which approximate typical classrooms, some have educational specialists who work with the local school district and even go into the classroom on a consultation basis after the child re-enters school. Some public schools throughout the country feature transitional classrooms in which the child's functioning can be closely monitored and within which there is more individualization and structure than the ordinary classroom (Blosser, 1997) and (Savage, 1997).

When a traumatic brain injury has been documented, it is important that one person from the school district be in charge of the actual reentry planning for the child. This should include a review of medical records, communication with therapists, and a comprehensive, multidisciplinary assessments as well as observation and the input of the family. An Individualized Education Plan (IEP) may be begun which will include the need for frequent reassessment, review and/or revision (probably every 2 months) since changes are typical of TBI (Holland, 1997) and (Blosser, 1997).

It may not be possible for some children to "catch up" on all of the homework and unit goals, which have been missed. The teacher, special educator, and psychologist may decide that a critical analysis of "missed material" is in order and some demands may be

eliminated entirely to avoid overloading the child. Home tutoring may assist in transitioning and one to one instruction may be appropriate both before and after the child begins attending school.

Some specialists have suggested that guidelines may be developed to aid in judging when a child is ready to return to a classroom. Some prerequisites noted from specialists in the field are: (Ylvisaker, 1995).

- Attend to task for 10-15 minutes
- Tolerate 20-30 minutes of general classroom stimulation (movements, distractions, noises)
- Function within a group of two or more students
- Follow simple directions
- Engage in some type of meaningful communication
- Give evidence of learning potential

The need to demonstrate "meaningful communication" or "learning potential" are subjective and have been the subject of various legal suits for educational rights.

Re-entry planning may use a continuum of settings, including residential educational facilities, self-contained, transitional classrooms, combination home tutoring or resource room and support services with a regular classroom environment. Obviously and combination of these may be used. The child may use individual instruction or work with small groups within a resource room for part of the time or intermittently while being based in a regular classroom. Adaptive equipment or techniques may be used in regular classrooms, such as a study carrel as a time-out opportunity as he learns to monitor his own needs and behaviors. It should also be noted that the combination of special

assistants, peer helpers, modified curriculum, adapted materials and techniques may make it possible t have a successful mainstream experience without the need for prerequisites (Tucker, 1992).

Careful planning is imperative with TBI children when they re-enter school. It is important to include linkages between the trauma center/rehabilitation hospital and the special education team at the school to help plan for the re-entry, and meeting the needs of the student. It is important to remember that many different areas may be impaired so to work constructively with students with TBI. Educators may need to: (Clark, 1996) and (Tucker, 1992)

- Provide consistency and repetition,
- Demonstrate new tasks, state instructions, and provide: examples to illustrate ideas and concepts
- Avoid figurative language
- Reinforce lengthening periods of attention to appropriate tasks
- Probe skill acquisition frequently and provide repeated practice
- Teach compensatory strategies for increasing memory
- Be prepared for student's reduced stamina and increased fatigue
- Provide breaks as needed
- Keep the learning environment as distraction free as possible.

It is most important to build opportunities for success and to maximize the child's strengths.

Role of the Classroom Teacher

The classroom teacher is in a critically important position regarding children and traumatic brain injury. First, he or she may be able to prevent TBI in some students through education and the modeling and enforcement of safe practices in a variety of school sponsored activities. Second, the teacher may assist in the identification of undiagnosed cases of TBI. Third, the teacher may create interventions which work for children who have suffered TBI who are mainstreamed by using the strengths of the child in order to promote learning and using strategies to compensate for lost abilities and skills. The teacher can also help to dispel misconceptions about TBI in her other students and create more accepting attitudes toward the child. Last but not least, the teacher can give emotional support to the child and to the family (Salter, 1998), (Szekeres, 1994) and (White, 1997)

Strategies to Use with Traumatic Brain Injured Students

The strategies that work with children who have sustained a TBI are some of the same strategies that we as teachers have learned about in the past. The child with TBI also presents an opportunity for the teacher to become more aware and more adept at balancing skills in one to one teaching, the mutually beneficial use of peer tutors, and cooperative teaching approaches with the more traditional whole class methods. Assessment and planning will seek to use the child's strengths and to overcome, remediate or compensate for his deficit. A primary aim is to find or adapt games, workbooks, activities, aids and techniques to encourage the development, practice, and secured learning necessary for success in school and life (Salter, 1998).

The purpose of some strategies is to retrain or develop thinking processes. While a great deal of computer software is created to improve memory, visual/spatial skills, and thinking processes (logic, sequencing, etc.), it is a mistake to think that computers are the only way cognitive training or practice can take place. Indeed, many old fashioned children's games and most workbooks have been created for these same purposes. One currently popular technique is to make a short series of individualized process cards for a child. The first might have a stop sign, the second a light bulb with the word "think", and the third a question mark and the words "Do you know the answer?" Thus when the child faces a dilemma, he refers to his cards. If the child does not know the answer, he may move on to a simplified flow chart which helps him ask himself what he needs to know and who can assist (Ylvisaker, 1998) and (White, 1997).

Some strategies are primarily compensatory. For example, there are various devices to orient children to space and time in order to compensate for their difficulties. To assist a child finding his way around the building, the teacher may construct or help the child construct graphic maps or sequential written directions if he processes better with language than visually or spatially. If the child tends to become disoriented for time and task, the teacher may find that putting the morning activities on the chalkboard may be sufficient for his reference when he feels "lost." Or, she may create a special card with clocks (White, 1997). Each day the clock hands can be filled in and labeled with activities or symbols representing activities. By matching the pictorials with the classroom clock the child will have a ready temporal resource to consult.

Other strategies and techniques, which are usually considered compensatory, are lists or audiotapes that aid in memory, journals, and many forms of prompts and cues. One

currently popular technique for helping children gather, process, and remember pertinent information is a "sun diagram." A circle represents the sun and lines radiating out around the diameter represent rays. The topic is written (or symbolized) in the circle and information regarding "who, what, where, when, why, and how" is placed on the lines (White, 1997).

A similar strategy to coach thinking process might be to create a flow chart. A flow chart is used to help children make decisions and give specific direction. Such a chart could be constructed to deal with one of the child's particular problems. It usually begins by having the child repeat and restate the problem and then asks a series of simple questions with yes or no answers. A green arrow can be placed after every "yes" answer to guide the child through a structured process to accomplish the goal (Ylvisaker, 1998).

Some strategies serve double duty; they may create learning through the practice of executive skills and also serve a compensatory function such as jogging the memory. For example, bookmarks can be made of various colors which signal immediate attention, intermediate time due date, and longer term/weekend work. These bookmarks may have pages and dates written on them as well and may correspond to a homework log which is created every Monday, for example, and has assignments written in matching colors for the week. This latter type of strategy may serve both as compensation for memory deficits and also as a learning strategy in that it helps develop or retrain a sense of time (Anderson, 1998).

Behavioral principles and strategies should be reviewed for ordinary teaching as well as for dealing with "acting out" or high visibility behaviors. Immediate feedback and intermittent reinforcement are powerful behavior tools as are visual cueing and verbal

prompting. Negative attention is reinforcing and the teacher needs to monitor him or herself so that undesirable behaviors are not unwittingly reinforced (Ylvisaker, 1998).

Videotaping the student's classroom performance is an excellent way to provide feedback and to demonstrate progress. It provides the student with an accurate record of his or her verbal and nonverbal behaviors. Videotape allows students an opportunity to assess their behavior and plan ways of changing it. Since, the head injured child's academic progress may be extremely slow, a videotape record over several weeks may help the student and family see academic gains, providing positive feedback (Kehle, 1996) and (Martin, 1998).

Traumatic brain injured students may be eligible for the services listed below:

- Notetakers to supplement the student's notes*
- Time extensions on tests and assignments*
- Restructuring class assignments*
- Testing in a small group and quiet location*
- Consultation with faculty to advocate for the student*
- Taped textbooks and assistance in ordering taped books*
- Written contracts to assist the student in achieving academic or personal goals*
- Assistance with financial aid applications, procedures and awards*
- Tutorial referral to campus and private services*
- Academic support groups for the purpose of review and discussion of barriers encountered on a college campus*
- Referral as needed to other campus and community resources
- Priority pre-registration

- Curriculum counseling regarding course selection and scheduling
- Regular meetings to discuss and monitor academic progress
- Access to state-of-the-art computer equipment in Adaptive Technology Lab

Indicates a reasonable accommodation as suggested by federal regulations or case law. Other services provided are above and beyond the legal requirements and are provided within resource allocation (http://www.dissvcs.uga.edu/abi.htm). These or any accommodations or modifications must be noted in the students IEP.

Conclusions

Traumatic brain injury (TBI) is a category of disability to receive special education services. Unfortunately, many children who have experienced TBI have not been diagnosed in medical settings nor have they received appropriate rehabilitation. In school, they are often not identified at all or may be misclassified and inappropriately grouped with children who are mentally retarded, learning disabled or emotionally disturbed.

It is most important to remember that while learning more about the commonalities of children with TBI as a group, it is more important to learn to individualize instruction for each child to help him/her learn successfully (White, 1997). A great deal of information is being created regarding the most up to date and frequent kinds of impairment, assessments which seem most helpful and the teaching strategies which seem most useful for assisting TBI children (Clark, 1996).

There is still some who feel schools and their staff have been ill-served by medical and rehabilitation specialists who have failed to recognize their role in the failure to bridge educational systems. Unfortunately, it is the child who ultimately suffers. Most

professionals in both the education and medical fields believe that integrating two very different systems such that of the medical and educational field becomes difficult when reintegrating the TBI student back into the classroom. Each field is influenced by their political, territorial, fiscal, and programmatic priorities. Only when schools and medical/rehabilitation centers truly understand and respect each other's resources and expertise can real collaboration begin and effective planning be accomplished. Most important is meeting the needs of the TBI student in either the medical or educational setting (Lash, Scarpino 1993).

Overall, there are many contributors who are an important part of the planning team and can provide information as to how the child functions at home and in social settings. This is especially helpful since children with TBI may have trouble generalizing and transferring classroom learning to other situations. The family needs support and should play an important role in planning for their child's educational future. Parents can find this support within the school system and through IDEA or Public Law 101-476. It should be noted that although this law specifies that children with traumatic brain injuries are in need of special education and related services some states, towns, and local schools have not necessarily been given the required funding, training, and staffing for its implementation.

References

Anderson, V., Fenwick, T., Manly, T., Roberston, I. Attentional skills following traumatic head injury in childhood: a componential analysis. Brain Injury, v12 n11 p937-950, 1998.

Bigler, E., and others. Traumatic brain injury and memory: the role of hippocampal atrophy. Neuropsychology, v10 n3 p333-342, 1996.

Blosser, J., Pearson, S. Transition coordination for students with brain injury: a challenge schools can meet. Journal of Head Trauma Rehabilitation, v12 n2 p21-31, 1997.

Clark, Elaine. Children and adolescents with traumatic brain injury: reintegration challenges in educational settings. Journal of Learning Disabilities, v29 n5 P549-60, September 1996.

DeJong, Gerben; Batavia, Andrew I. Societal duty and resource allocation for persons with severe traumatic brain injury. Journal of Head Trauma Rehabilitation; v4 n1 p1-12, March 1989.

DePompei, R., and others. Educational needs of children and adolescents after brain injury: a global perspective. Neurorehabilitation, v11 n2 p85-100, 1998.

Dijkers, M. Measuring the long-term outcomes of traumatic brain injury: a review of the community integration questionnaire. Journal of Head Trauma Rehabilitation, v12 n6 p74-91 1997.

Donders, Jacques. Academic placement after traumatic brain injury. Journal of School Psychology; v32 n1 p53-65, spring 1994.

D'Amato, Rik Carl; Rothlisberg, Barbara A. How education should respond to students with traumatic brain injury. Journal of Learning Disabilities, v29 n6 p670-83, November 1996.

Holland, D., Hogg, J., and Farmer, J. Fostering effective team cooperation and communication: developing community standards within interdisciplinary cognitive rehabilitation settings. Neurorehabilitation, v8 n1 p21-30 1997.

Hux, Karen; and others. Traumatic brain injury: knowledge and self-perceptions of school speech-language pathologists. Language, Speech, and Hearing Services in Schools; v27 n2 p171-84, April 1996.

Janus, P., and others. Beyond school re-entry: addressing the long term needs of students with brain injuries. Neurorehabilitation, v9 n2 p133-148, 1997.

Jennett, B. Epidemiology of head injury. Neurology, Neurosurgery, and Psychiatry, v60 n4 p362-369, 1996.

Kehle, Thomas J.; and others. Interventions for students with traumatic brain injury: managing behavioral disturbances. Journal of Learning Disabilities, v29 n6 p633-42 November 1996.

Martin, Darlene Aulds. Children and adolescents with traumatic brain injury: impact on the family. Journal of Learning Disabilities, v21 n8 p464-70, October 1998.

McNeill, D., Schuyler, B. and Ezachi, O. Assessing family involvement in traumatic brain injury rehabilitation: the development of a new instrument. Archives of Clinical Neuropsychology, v12 n10 p683-690 1997.

Nabors, N., Millis, S., Halson, D., Bunning, S., Moon, T. Use of the neurobehavioral cognitive status examination (cognistat) in traumatic brain injury. Journal of Head Trauma Rehabilitation, v12 n3 p69-78, 1997).

Russell, Nancy K. Educational considerations in traumatic brain injury: the role of the speech-language pathologist. Language, Speech, and Hearing Services in Schools, v24 n2 p67-75, April 1993.

Salter-Moss, K., and Freeland, J. Procedural learning techniques in brain injury rehabilitation. Brain Injury Source, v2 n3 p 22-25 1998.

Savage, R. Integrating rehabilitation and education services for school-age children with brain injuries. Journal of Head Trauma Rehabilitation, v12 n2 p11-20, 1997.

Shiel, A. & Wilson, B. Assessment after extremely severe head injury in a case of life or death: a further support for McMillan. Brain Injury, v12 n10 p809-816, 1998.

Suhr, J., Tranel, D., Wefel, J. Memory performance after head injury: contributions of malingering litigation status, psychological factors, and medication use. Journal of Clinical and Experimental Neuropsychology, v11 n4 p545-551, 1997.

Szekeres, Shirley F.; Meserve, Nancy F. Collaborative intervention in schools after traumatic brain injury. Topics in Language Disorders; v15 n1 p21-36, November 1994.

Tucker, Bonnie Foster; Colson, Steven E. Traumatic brain injury: an overview of school re-entry. Intervention in School and Clinic, v27 n4 p198-206, March 1992.

United Stated Federal Register, v57 n189 p44802, September 1992.

Vieth, Z., and others. Extent of intellectual, cognitive and academic decline in adolescent traumatic brain injury. Brain Injury, v10 n6 p465-470 1996.

Waop.eyes.org

White, S., and others. Compensatory strategies for people with traumatic brain injury. Neurorehabilitation, v9 n3 p205-212 1997.

Ylvisaker, M. et al. School reentry following severe traumatic brain injury: guidelines for educational planning. Journal of Head Trauma Rehabilitation, v10 n6 p25-41, 1995.

Ylvisaker, M., and Feeney, T. Integrating functional approaches to cognition, communication and behavior after tbi. Brain Injury Source, v2 n3 p12-17 1998.

Yohman, J. Practical suggestions for problem solving and social communication. Brain Injury Source, v2 n3 p28-31 1998.